III. REMARKS

1. Claim 1 has been amended for clarity. The subject matter defined by claims 2-4 and 23 has been incorporated into claim 1. Accordingly, claims 2-4 and 23 have been cancelled without prejudice.

Claim 5 has been amended for clarity.

Claim 12 has been amended for clarity. The subject matter defined by claims 13-15 and 28 has been incorporated into claim 12. Accordingly, claims 13-15 and 28 have been cancelled without prejudice.

The amendments made to the claims are fully supported by the application as originally filed. No new matter has been introduced by way of the amendments made to the claims.

2. Claim 1 is not unpatentable under 35 U.S.C. 103(a) over Makino et al. (US Patent No. 626760), hereinafter referred to as Makino, in view of Brennan et al. (US Patent No. 6240192), hereinafter referred to as Brennan.

With respect to the rejections to claim 1, the Examiners has stated that Makino discloses that the subband signals are whitened (Col. 3, l. 25-35). With respect to the rejections to claims 2, 3, 13, and 14, the Examiners has stated that Makino discloses that the signals are whitened in frequency domain and that "whitening inherently comprises emphasizing certain frequencies (adding noise)...".

Applicant respectfully disagrees with the Examiner. Makino's whitening is totally different from the method disclosed in the present application. Makino states in Col. 3, l. 25-35 that the projection algorithm (ESP in Makino) removes the autocorrelation of the input signal in time-domain and "hence it means whitening of the signals in the time domain" (Col. 3, l.30-32). This is an implicit whitening by the projection algorithm applied in time domain. This is further emphasized in Col. 4, l. 55-65 of Makino.

By contrast, claim 1 contains three whitening steps (a)-(c) which are all explicitly applied in subband domain and not implicitly as in ESP method. Whitening by spectral emphasis applies a pre-designed FIR filter to complex-valued subband domain signals that are next processed by adaptive processing. Whitening by adding noise and by decimation similarly explicitly whiten the signal after oversampled filterbank analysis and before adaptive processing.

The whitening techniques disclosed in the present application are specifically designed for adaptive processing on oversampled filterbanks as recited in claim 1. This is in contrast to Makino's method that uses a generic property of the ESP algorithm applied in time domain or frequency domain. Makino does not disclose or suggest adaptive processing on oversampled filterbanks as claimed by Applicant.

The whitening in frequency domain by Makino is due to subband decomposition (Makino Col. 5, l. 5-35 and Col. 11, l.25-37). By contrast, the whitening techniques in the present application are applied after subband decomposition and to the subband signal.

The oversampled filterbank does not benefit from the whitening due to subband decomposition as the oversampling effectively leads to coloration of subband signal. In fact, the methods of whitening disclosed in the present application are advised to overcome this problem.

With respect to the rejection to claim 1, the Examiner has further stated that Brennan discloses a method of noise reduction, equating the noise reduction with echo cancellation.

It is respectfully submitted that noise reduction is different from echo cancellation. In echo cancellation the interference is a replica of the input after some linear/nonlinear filtering and as such correlated with the desired input signal. In noise reduction the interference can generally be produced by any independent source and no assumption is made on the correlation between the input and noise interference. As a result,

methods applied to echo cancellation are designed specifically to benefit from the fact that the signal and the interference are produced by the same source(s). Brennan does not disclose or suggest any method of more efficient echo cancellation.

In fact, employing oversampled filterbanks for subband adaptive filtering encounters a major convergence problem due to oversamplings. This issue is not addressed in Brennan or Makino and is not obvious to one skilled in the art.

The dependent claims have additional features not suggested or taught by Makino and Brennan.

For example, with respect to the rejections to claims 4 and 15, the Examiner has stated that Brennan discloses that oversampling of input signals leads to whitening of the inputs. This is not correct and not disclosed in Brennan. In fact, the reverse is true as oversampling does not allow the subband signal to be white in spectrum.

With respect to the rejection to claim 9, the Examiner has stated that the analog/digital converters (A/Ds) disclosed by Brennan inherently have a frequency response and this will act to filter out noise. However, it is a known technical fact that A/D's cannot filter out the in-band noise as they cannot discriminate between signal and noise. The echo cancellation deals with the in-band noise, i.e. the noise in the same frequency band as the desired signal.

With respect to the rejection to claims 11 and 22, as discussed above, a noise signal and an echo signal are not the same.

With respect to the rejections to claims 10 and 21, the Examiner has stated that Brennan's subband method comprises two adaptive filters per subband (26, 30 in Fig. 1). However, the elements 26 and 30 in Fig. 1 of Brennan are analysis filterbank and synthesis filterbanks respectively. Brennan does not disclose or suggest "two adaptive filters per subband".

With respect to the rejections to claims 23-25, 27-30, and 32, applying Brennan's oversampled filterbank to adaptive processing in subbands is impeded by many problems including the convergence reduction problem as detailed in the present application. These problems and their solutions are not disclosed in either or Brennan or Makino and are not obvious to the one skilled in the art.

With respect to the rejections to claims 26 and 31, the Examiner has stated that the echo canceller of Brennan acts to adapt filter coefficients to produce an echo estimate to be subtracted from the near-end signal. However, Brennan does not disclose or suggest any adaptive filter coefficients. In Fig. 1 of Brennan, blocks 28 are only multipliers (designated by X) and not adaptive filters. There is no adaptive filter in Fig. 1 of Brennan.

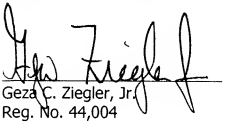
Hence it is respectfully submitted that claims 1 and 12 and their dependent claims are patentable in view of the cited references. Applicant respectfully requests reconsideration and withdrawal of the rejections.

In view of the amendments and the remarks, and having dealt with all the objections raised by the examiner, reconsideration and allowance of the application is courteously requested.

For all of the foregoing reasons, it is respectfully submitted that all of the claims now present in the application are clearly novel and patentable over the prior art of record, and are in proper form for allowance. Accordingly, favorable reconsideration and allowance is respectfully requested. Should any unresolved issues remain, the Examiner is invited to call Applicants' attorney at the telephone number indicated below.

The Commissioner is hereby authorized to charge payment for any fees associated with this communication or credit any over payment to Deposit Account No. 16-1350.

Respectfully submitted,



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